

# OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **Dodge Pond, Lyman**, the program coordinators have made the following observations and recommendations.

We congratulate your group for sampling your pond **once** this summer. However, we **strongly** encourage your monitoring group to sample **additional** times each summer. Typically, we recommend that monitoring groups sample **three times** per summer (once in **June, July**, and **August**). We understand that the number of sampling events you decide to conduct per summer will depend upon volunteer availability, and your monitoring group's goals and funding availability. However, with a limited amount of data it is difficult to determine accurate and representative water quality trends. Since weather patterns and activity in the watershed can change throughout the summer, from year to year, and even from hour to hour during a rain event, it is a good idea to sample the pond at least once per month during the summer.

If you are having difficulty finding volunteers to help sample or to travel to one of the laboratories, please call the VLAP Coordinator and DES will help you work out an arrangement.

If your monitoring group's sampling events this year were limited due to not having enough time to pick-up or drop-off samples at the Limnology Center in Concord, please remember the Plymouth State University Center for the Environment Satellite Laboratory is open in Plymouth. This laboratory was established to serve the large number of lakes/ponds in the greater North region of the state. This laboratory is inspected by DES and operates under a DES approved quality assurance plan. We encourage your monitoring group to utilize this laboratory next summer for all sampling events, except for the annual DES biologist visit. To find out more about the Center for the Environment Satellite Laboratory, and/or to schedule dates to pick up bottles and equipment, please call Janet Towse or Adam Baumann, laboratory managers, at (603) 535-3269.

We encourage your monitoring group to formally participate in the DES Weed Watchers program, a volunteer program dedicated to monitoring lakes and ponds for the presence of exotic aquatic plants. This program only involves a small amount of time during the summer months.

Volunteers survey their waterbody once a month from **May** through **September**. To survey, volunteers slowly boat, or even snorkel, around the perimeter of the waterbody and any islands it may contain. Using the materials provided in the Weed Watcher kit, volunteers look for any species that are suspicious. After a trip or two around the waterbody, volunteers will have a good knowledge of its plant community and will immediately notice even the most subtle changes. If a suspicious plant is found, the volunteers immediately send a specimen to DES for identification. If the plant specimen is an exotic species, a biologist will visit the site to determine the extent of the problem and to formulate a management plan to control the nuisance infestation. Remember that early detection is the key to controlling the spread of exotic plants.

If you would like to help protect your lake or pond from exotic plant infestations, contact Amy Smagula, Exotic Species Program Coordinator, at 271-2248 or visit the Weed Watchers website at [www.des.nh.gov/organization/divisions/water/wmb/exoticspecies/weed\\_watcher.htm](http://www.des.nh.gov/organization/divisions/water/wmb/exoticspecies/weed_watcher.htm).

## FIGURE INTERPRETATION

### CHLOROPHYLL-A

- **Figure 1 and Table 1:** Figure 1 in Appendix A shows the historical and current year chlorophyll-a concentration in the water column. Table 1 in Appendix B lists the maximum, minimum, and mean concentration for each sampling year that the pond has been monitored through VLAP.

Chlorophyll-a, a pigment found in plants, is an indicator of the algal abundance. Algae (also known as phytoplankton) are typically microscopic, chlorophyll producing plants that naturally occur in lake ecosystems. The chlorophyll-a concentration measured in the water gives biologists an estimation of the algal concentration or lake productivity. **The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m<sup>3</sup>.**

The current year data (the top graph) show that the chlorophyll-a concentration was **4.39 mg/m<sup>3</sup>** in **July**.

The historical data (the bottom graph) show that the **2008** chlorophyll-a mean is ***slightly less than*** the state and similar lake

medians. For more information on the similar lake median, refer to Appendix F.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a **decreasing** in-lake chlorophyll-a trend since monitoring began. Specifically the mean chlorophyll concentration has **improved** since **2006**.

Please keep in mind that this observation is based on limited data. As your group expands its sampling program to include additional events each year, we will be able to determine trends with more accuracy and confidence.

After 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

While algae are naturally present in all ponds, an excessive or increasing amount of any type is not welcomed. In freshwater ponds, phosphorus is the nutrient that algae typically depend upon for growth in New Hampshire lakes. Algal concentrations may increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management practices that can be implemented to minimize phosphorus loading to surface waters.

## TRANSPARENCY

- **Figure 2 and Tables 3a and 3b:** Figure 2 in Appendix A shows the historical and current year data for transparency with and without the use of a viewscope. Table 3a in Appendix B lists the maximum, minimum and mean transparency data without the use of a viewscope and Table 3b lists the maximum, minimum and mean transparency data with the use of a viewscope for each year that the pond has been monitored through VLAP.

Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can be affected by the amount of algae and sediment in the water, as well as the natural color of the water. **The median summer transparency for New Hampshire's lakes and ponds is 3.2 meters.**

The current year data (the top graph) show that the non-viewscope in-lake transparency was **2.6 meters** in **July** and the Secchi disk was

visible on the pond bottom. The viewscope transparency was not measured.

The historical data (the bottom graph) show that the **2008** mean non-viewscope transparency is ***slightly less than*** the state and similar lake medians. Please refer to Appendix F for more information about the similar lake median.

Overall, visual inspection of the historical data trend line (the bottom graph) shows an ***increasing*** trend for in-lake non-viewscope transparency, meaning that the transparency has ***improved*** since monitoring began in **2006**.

Please keep in mind that this observation is based on limited data. As your group expands its sampling program to include additional events each year, we will be able to determine trends with more accuracy and confidence.

Again, please keep in mind that this trend is based on only ***three*** years of data. As previously discussed, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts should continually be made to stabilize stream banks, pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the pond. Guides to best management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

### **TOTAL PHOSPHORUS**

- **Figure 3 and Table 8:** The graphs in Figure 3 in Appendix A show the amount of epilimnetic (upper layer) phosphorus and hypolimnetic (lower layer) phosphorus; the inset graphs show current year data. Table 8 in Appendix B lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the pond has been sampled through VLAP.

Phosphorus is typically the limiting nutrient for vascular plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a pond can lead to increased plant and algal growth

over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration was **7.4 ug/L in July**.

The historical data show that the **2008** mean epilimnetic phosphorus concentration is ***less than*** the state and similar lake medians. Refer to Appendix F for more information about the similar lake median.

The hypolimnetic total phosphorus concentration was not measured in 2008. The pond is shallow and does not thermally stratify into two lake layers; therefore it is not necessary to collect a hypolimnion sample.

Overall, visual inspection of the historical data trend line for the epilimnion shows a ***variable*** phosphorus trend. Specifically, the mean annual epilimnetic phosphorus concentration has ***fluctuated between approximately 7.4 and 13 ug/L*** since monitoring began in **2006**.

Please keep in mind that this observation is based on limited data. As your group expands its sampling program to include additional events each year, we will be able to determine trends with more accuracy and confidence.

As discussed previously, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean phosphorus concentration since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the watershed sources of phosphorus and how excessive phosphorus loading can negatively affect the ecology and the recreational, economical, and ecological value of lakes and ponds.

#### **TABLE INTERPRETATION**

##### ➤ **Table 2: Phytoplankton**

Table 2 in Appendix B lists the current and historical phytoplankton and/or cyanobacteria observed in the pond. Specifically, this table lists the three most dominant phytoplankton and/or cyanobacteria observed in the sample and their relative abundance in the sample.

The dominant phytoplankton and/or cyanobacteria observed in the **July** sample were ***Chrysosphaerella* (Golden-Brown)**, ***Dinobryon* (Golden-Brown)**, and ***Oscillatoria/Synedra* (Cyanobacteria/Diatom)**.

Phytoplankton populations undergo a natural succession during the growing season. Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding seasonal plankton succession. Diatoms and golden-brown algae populations are typical in New Hampshire’s less productive lakes and ponds.

➤ **Table 2: Cyanobacteria**

A **small amount** of the cyanobacterium ***Oscillatoria*** was observed in the **July** plankton sample. ***This cyanobacteria, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans.*** Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding cyanobacteria.

Cyanobacteria can reach nuisance levels when phosphorus loading from the watershed to surface waters is increased and favorable environmental conditions occur, such as a period of sunny, warm weather.

The presence of cyanobacteria serves as a reminder of the pond’s delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading to the pond by eliminating lawn fertilizer use, keeping the pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface in high concentrations. Wind and currents tend to “pile” cyanobacteria into scums that accumulate in one section of the pond. If a fall bloom occurs, please collect a sample in any clean jar or bottle and contact the VLAP Coordinator.

➤ **Table 4: pH**

Table 4 in Appendix B presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.6**, which indicates that the state surface waters are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean pH at the deep spot this year was **7.13** in the epilimnion, which means that the water is ***slightly basic***.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 in Appendix B presents the current year and historical epilimnetic ANC for each year the pond has been monitored through VLAP.

Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.8 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean acid neutralizing capacity (ANC) of the epilimnion (upper layer) was **25.3 mg/L**, which is ***much greater than*** the state median. In addition, this indicates that the pond is ***not vulnerable*** to acidic inputs.

➤ **Table 6: Conductivity**

Table 6 in Appendix B presents the current and historical conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **38.4 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean annual epilimnetic conductivity at the deep spot this year

was **66.66 uMhos/cm**, which is *slightly greater than* the state median.

The **2008** conductivity results for the deep spot and tributaries were *lower than* has been measured **since monitoring began**.

It is likely that slow spring snowmelt allowed any chloride contributions to infiltrate into the groundwater and not directly into surface waters. Also, the record rainfall during the **2008 summer season** possibly diluted the ion concentration in surface waters throughout the watershed. Specifically, the significant summer rainfalls likely increased the flushing rate for many lakes/ponds allowing potential watershed pollutants to flush through the system and not concentrate in the stratified surface waters.

It is possible that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the pond. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

*A limited amount of chloride sampling was conducted during **2008**. Please refer to the discussion of **Table 13** for more information.*

Therefore, we recommend that the **epilimnion** (upper layer) be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

*Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.*

➤ **Table 8: Total Phosphorus**

Table 8 in Appendix B presents the current year and historical total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The phosphorus concentration in the **tributaries** was *relatively low* this year, which is good news. However, we recommend that your monitoring group sample the major tributaries to the pond during snow-melt and periodically during rainstorms to determine if the phosphorus concentration is **elevated** in the tributaries during these times. Typically, the majority of nutrient loading to a pond occurs in



the spring during snow-melt and during intense rainstorms that cause soil erosion and surface runoff and within the watershed.

*For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at <http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.*

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) collected during **2008**. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of sufficient amounts of dissolved oxygen in the water column is vital to fish and amphibians and bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The dissolved oxygen concentration was **high** at all deep spot depths sampled in the pond on the **July** sampling event. Typically, shallow lakes and ponds that are not deep enough to stratify into more than one or two thermal layers will have relatively high amounts of oxygen at all depths. This is due to continual lake mixing and diffusion of oxygen into the bottom waters induced by wind and wave action.

➤ **Table 11: Turbidity**

Table 11 in Appendix B lists the current year and historical data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

The tributary and deep spot turbidity was **relatively low** this year, which is good news.

However, we recommend that your group sample the pond and any surface water runoff areas during significant rain events to determine if stormwater runoff contributes turbidity and phosphorus to the pond.

*For a detailed explanation on how to conduct rain event sampling, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at <http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.*

➤ **Table 12: Bacteria (*E. coli*)**

Table 12 in Appendix B lists the current year and historical data for bacteria (*E. coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E. coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present.

The *E. coli* concentration was **very low** at the **Beach** station sampled on the **July** sampling event. Specifically, the result was **7 counts**, which is ***much less than*** the state standard of 406 counts per 100 mL for recreational surface waters that are not designated public beaches and 88 counts per 100 mL for surface waters that are designated public beaches.

➤ **Table 13: Chloride**

Table 13 in Appendix B lists the current year and the historical data for chloride sampling. The chloride ion (Cl<sup>-</sup>) is found naturally in some surfacewaters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than 2 mg/L in surface waters located in remote areas away from habitation. The median epilimnetic chloride value for New Hampshire lakes and ponds is **5 mg/L**. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The **epilimnion** was sampled for chloride during the **July** sampling event. The result was **< 5 mg/L**, which is ***much less than*** the state acute and chronic chloride criteria. However, this concentration is ***greater than*** what we would normally expect to measure in undisturbed New Hampshire surface waters.

We recommend that your monitoring group continue to conduct chloride sampling in the epilimnion at the deep spot, particularly in the spring soon during snow-melt and during rain events during the summer. This will establish a baseline of data that will assist your monitoring group and DES to determine lake quality trends in the future.

*Please note that chloride analyses can be run free of charge at the DES Limnology Center. Please contact the VLAP Coordinator if you are interested in chloride monitoring. In addition, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.*

➤ **Table 14: Current Year Biological and Chemical Raw Data**

Table 14 in Appendix B lists the most current sampling year results. Since the maximum, minimum, and annual mean values for each parameter are not shown on this table, this table displays the current year “raw,” meaning unprocessed, data. The results are sorted by station, depth, and then parameter.

➤ **Table 15: Station Table**

As of the spring of 2004, all historical and current year VLAP data are included in the DES Environmental Monitoring Database (EMD). To facilitate the transfer of VLAP data into the EMD, a new station identification system had to be developed. While volunteer monitoring groups can still use the sampling station names that they have used in the past and are most familiar with, an EMD station name also exists for each VLAP sampling location. Table 15 in Appendix B identifies what EMD station name corresponds to the station names you have used in the past and will continue to use in the future.

## **DATA QUALITY ASSURANCE AND CONTROL**

### **Annual Assessment Audit:**

During the annual visit to your pond, the biologist conducted a sampling procedures assessment audit for your monitoring group. Specifically, the biologist observed the performance of your monitoring group and completed an assessment audit sheet to document the volunteer monitors’ ability to follow the proper field sampling procedures, as outlined in the VLAP Monitor’s Field Manual. This assessment is used to identify any aspects of sample collection in which volunteer monitors failed to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an **excellent** job collecting samples on the annual biologist visit this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and

there was no need for the biologist to provide additional training. Keep up the good work!

#### **USEFUL RESOURCES**

*Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials*, DES Booklet WD-03-42, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf](http://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf).

*Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms*, DES fact sheet WMB-10, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf).

*Erosion Control for Construction in the Protected Shoreland Buffer Zone*, DES fact sheet WD-SP-1, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-1.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-1.pdf).

*Impacts of Development Upon Stormwater Runoff*, DES fact sheet WD-WQE-7, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/factsheets/aot/documents/wqe-7.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/aot/documents/wqe-7.pdf).

*Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes*, DES fact sheet WD-BB-9, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-9.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-9.pdf).

*Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act*, DES fact sheet WD-SP-2, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-2.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-2.pdf).

*Road Salt and Water Quality*, DES fact sheet WD-WMB-4, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf).

*Shorelands Under the Jurisdiction of the Comprehensive Shoreland Protection Act*, DES fact sheet SP-4, (603) 271-2975 or

[www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-4.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-4.pdf).

*Soil Erosion and Sediment Control on Construction Sites*, DES fact sheet WQE-6, (603) 271-2975 or  
[www.des.nh.gov/organization/commissioner/pip/factsheets/aot/documents/wqe-6.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/aot/documents/wqe-6.pdf).

*Through the Looking Glass: A Field Guide to Aquatic Plants*, North American Lake Management Society, 1988, (608) 233-2836 or  
[www.nalms.org](http://www.nalms.org).

*Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants*, DES fact sheet WD-BB-4, (603) 271-2975 or  
[www.des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-4.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-4.pdf).

*Watershed Districts and Ordinances*, DES fact sheet WD-WMB-16, (603) 271-2975 or  
[www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-16.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-16.pdf).